1999 ANNUAL REPORT

NATIBO

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Table of Contents

Background 1

Organization 1

Focus/Objectives 2

Membership 2

Calendar Year 1999 Projects

Rechargeable Battery/Systems for Communication/Electronic Applications Industrial Base Study 3
Biological & Hybrid Detection Systems Study 3
Corrosion Detection Technology Insertion Project 3
Ion Beam Technology Insertion Project 3
Metal Matrix Composite (MMC) Insertion Project 5
CY2000 Study or Project 6

Other Activities

Steering Group Meeting 7
Marketing 7
Exhibit 7
Memorandum of Understanding (MOU) 8
Presentations 8
Sector Study Guide 8
Awards 8
Representative Changes 8
Contractor Support 9

Funding 9

Planned Activities for Calendar Year 2000

Biological & Hybrid Detection Systems Study 10
Ion Beam Technology Insertion Project 10
Metal Matrix Composite Insertion Project 10
Next Technology Study or Project 10
Memorandum of Understanding 11
Exhibit Schedule 11

Conclusion..... 11

Appendix A NATIBO Membership A-1

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North American Technology and Industrial Base Organization (NATIBO)

Calendar Year 1999 Annual Report

Background

At the 1985 Shamrock Summit, Ronald Reagan, President of the United States, and Brian Mulroney, Prime Minister of Canada, pledged to work to reduce barriers and to stimulate the two-way flow of defense goods, establish a free exchange of technology knowledge and skill involved in defense production. This led to the establishment of the Charter signed by the two nations Defense Departments on March 23, 1987. At that time the NATIBO focused on the combined capacity and capability of the defense industrial bases of the U.S. and Canada to jointly support military requirements. In 1992 the organization determined it needed to review its objectives and explore new roles and initiatives to respond to the challenges of the 1990s. This change is reflected in more focus on technology vice industrial capacity issues. The NATIBO is now charged with ensuring a cost effective, healthy, technology and industrial base that is responsive to the national and economic security needs of the United States and Canada.

Organization

The NATIBO is co-chaired by the Director, Office of Technology Transition, for the U.S. and the Director General International & Industry Programs, for Canada. U.S. members represent the Office of Secretary of Defense, Army, Navy, Air Force, Marines, Defense Logistics Agency, Defense Contract Management Command, and the Office of Joint Chief of Staff. Canadian representation is from the Department of National Defence and Public Works & Government Services Canada. These representatives form the Steering Group and provide strategic direction, approve projects, review the progress of the Organization, and act as a conduit for addressing recommendations to U.S. and Canadian authorities. The U.S. Federal Emergency Management Agency is a nonvoting member and is the liaison for the U.S. federal civil departments and agencies. Industry Canada is an observer supporting assessment and insertion opportunities.

Subcommittees and working groups, either standing or ad hoc, are established by the Steering Group to address specific areas of concern and propose courses of action to the Steering Group for all assigned tasks. Current working groups are Technology Base Enhancement, Ion Beam Technology, Metal Matrix Composites, Biological Detection Systems, and Marketing.

The U.S. Army Materiel Systems Analysis Agency is the NATIBO Secretariat. The Secretariat is responsible for all administrative functions in support of the NATIBO, including the planning and recording of meetings, the correspondence with and between sub-committees, the maintenance of a central repository of data/files on NATIBO activities, and other business management duties as assigned by the Steering Group.

Focus/Objectives

- Promote the development, administration, communication, and execution of the U.S. Department of Defense and Canadian Department of National Defence technology and industrial base programs and policies.

- Foster cooperation between the Governments of the United States and Canada in development of coordinated technology and industrial base policies and programs, including policies and programs that promote the integration of the defense and commercial industrial sector and the greater use of dual use products and technologies.

- Leverage resources through cost sharing and economies of scale afforded through coordinated studies and projects involving research, development, industrial capability, and logistics programs.

- Promote the interchange of technology and industrial base data between Canada and the U.S., the military services, other government agencies, and industry.

- Promote coordination of technology and industrial base planning and insertion programs undertaken by the responsible U.S. and Canadian departments and agencies in support of their national security responsibilities.

- Facilitate enhanced joint activity through Canada/U.S. involvement in studies and implementation of resulting technology and industrial base recommendations.

- Ensure that North American technology and industrial base considerations are taken into account during U.S. or Canadian military and/or civilian emergency planning activities.

- Enhance the national security of both nations by promoting the competitiveness of the North American technology and industrial base.

- In performing the above, raise issues with relevant bi-lateral committees in those cases where interface between the NATIBO and these committees is determined to be advisable.

Membership

The NATIBO Steering Group membership is provided in Appendix A. In addition to member name, the mailing address, phone number and e-mail address are provided.

Calendar Year 1999 Projects

Rechargeable Battery/Systems for Communication/Electronic Applications Industrial Base Study. The NATIBO undertook a study to focus on rechargeable batteries and smart charger technology. The study gives a complete and thorough analysis of rechargeable battery chemistries and technology trends; an overview of current and potential defense and commercial applications of rechargeable batteries; highlights rechargeable battery and battery charger demographics, providing information on cell producers and repackagers; identifies the defense and commercial institutions currently active in research and development in the rechargeable battery and battery charger field; and pinpoints facilitators and barriers effecting more widespread use of rechargeable battery technologies. The rechargeable battery portion is limited to communication and electronic applications. The smart charger portion focuses on the industrial base and research and development. The report was published in September 1999 and is available from the NATIBO website at http://www.dtic.mil/natibo.

Biological & Hybrid Detection Systems Study. A Biological Detection Working Group was established in April 1999. The group determined that biological and biological/hybrid detection technologies for point and stand-off detection systems were the areas that provided a window of opportunity. For this study, biological/hybrid detection technologies refers to those technologies that can detect biological and chemical agents.

The objective of the study is to identify technologies that are expected to mature over the 2-4 year timeframe and have potential for meeting target military requirements for biological detection and identification. These technologies will be analyzed for their applicability to military requirements, for the industrial base supporting them, and for any impediments that present barriers to their effective implementation.

MAJ Norman Saulnier and Mr. Rod White are the Technical Project Officers for this project.

Corrosion Detection Technology Insertion Project. The Working Group met to consider the recommendations of the technology study with respect to a follow on technology insertion project. One of the significant recommendations of the report was to develop a widely applicable, dual use insertion/demonstration program. A candidate project might include multi-sensors and multiple data fusion, incorporating automation/robotics as deemed feasible. Several Working Group meetings were held to scope a potential project that is technically feasible, has dual use application, and would generate a high payoff. It was determined this project would be complementary to several U.S. Air Force efforts. Therefore, the NATIBO transitioned this project to the Air Force with the recommendation that their report include listing applications where the technology can be used, as well as potential cost savings for a given application.

Ion Beam Technology Insertion Project. A technology insertion project is underway to demonstrate and validate ion implantation as a viable process for improving the corrosion resistance and wearability of military components. The Marine Corps Amphibious Assault Vehicle (AAV) gun elevation mechanism gears and the Navy s CH-46 Helicopter planetary transmission gear are the two projects selected for chromium ion implantation.

Corrosion causes the elevation mechanism on the AAV to seize. This severely limits the capability to elevate the guns and requires replacement of the entire assembly at a cost of $6000. Anticipated benefits of this test will be enhanced corrosion resistance, reduced maintenance and acquisition costs and improved operational readiness. During calendar year 1998 the components from one elevation mechanism were implanted with chromium ions and the components from a second elevation mechanism were implanted with tantalum ions using the Navy s ManTech ion implanter. The components were analyzed at the Navy Research Laboratory to verify quantity of ions implanted and uniformity. The components were shipped to the Marine Corps in December 1998 for installation and test in operational AAVs but the shipment was misplaced for a considerable period of time. The shipment was located and the AAV program office is considering installing the implanted components on AAVs that are scheduled to go on a deployment in the near future. A critical issue is how the components will be tracked once the AAVs are placed onboard a ship.

The CH-46 planetary transmission gear experiences excessive general and pitting corrosion resulting in premature rejection and replacement during overhaul. The average usage rate is 40 rejections per month, with more than 80% of these rejections due to corrosion, at an item cost of $2000. The anticipated benefit of implanted transmission gears is increased resistance to general and pitting corrosion and reduced maintenance and acquisition costs. Two sets of components from the planetary gear were implanted in the Fall of 1998 and were scheduled to have been elevated in a transmission rig test at Boeing Philadelphia. However, because there was some discoloration as a result of the ion implantation, the Boeing and Navy engineers believed that this was due to overheating of the components during implantation, which could have an impact on their fatigue life. The Navy Research Laboratory project manager indicated that the discoloration represented a very thin film that had been deposited due to sputtering from fixtures holding the components in the vacuum chamber and that this would not affect fatigue life. However, the engineers could not be dissuaded and refused to allow the testing to go forward. They indicated that they would like to see some standard fatigue measurements taken on ion implanted coupons. This is now being pursued with Boeing and the Navy.

Corpus Christi Army Depot (CCAD) is testing nitrogen ion implantation into chrome plated journals in the Army s CH-47 Helicopter power steering pump. The pump prematurely fails due to journal wear that results in reduced service life. The anticipated benefits of the implanted parts are increased wear or service life, reduced overhaul replacement costs, and the reduction of hexavalent chromium and associated costs. There have been many delays on this portion of the project. CCAD previously obtained permission to fly treated components since this is not a flight safety critical part. At this time CCAD wants to recheck this, since rules "keep changing." The CCAD nitrogen implanter is not operational and it is unknown when it will be up and running.

If the ion beam insertion project test results are favorable the study team will promote the use of ion implantation technologies into current industrial processes used in the manufacture and repair of military weapon system platforms. The project, started in 1998, is a two-year effort. Mr. Bruce Sartwell, Naval Research Laboratory, is the Technical Project Officer. We estimate $290k (US) is required for the total effort.

Metal Matrix Composite (MMC) Insertion Project. This insertion project began after conducting a sector study in 1993 to assess the potential for the MMC industrial base to continue to advance and remain viable in the current and projected future economic environments. The goals of the project, which is a four-year effort, are to demonstrate the benefits obtainable by using selectively reinforced aluminum MMC components in military systems, and to establish the viability of MMC applications in the commercial world, while lowering the cost of producing these composites.

This NATIBO project is concentrating on demonstrating a cost reduction for the silicon carbide whiskers, the preform process that allows for selective placement of reinforcement, the squeeze cast manufacturing process, and demonstrating an improved rubber formula for use on track pads and bushings and then transferring the technology. The two major applications selected for this project are a double pin track shoe for medium weight tracked combat vehicles and an Advanced Medium Range Air-to-Air Missile (AMRAAM) seeker support structure. The Crusader, Future Scout and Cavalry System, Advanced Amphibious Assault Vehicle, and Abrams Program Offices are following this project and are interested in the outcome.

The squeeze cast process has been used to fabricate a vehicle set of NATIBO double pin track for field evaluation in addition to numerous test samples for material evaluations at the General Motors Advanced Materials and Development Center in Saginaw, Michigan. The 700-ton squeeze casting cell has been moved to Anniston, Alabama, in a United Defense Limited Partnership (UDLP) facility. Based on the results of the testing, the process will be optimized and operational in January 2000. Several preform processes have been evaluated for factors such as cost, ease of manufacture, production rates, and consistency. The best processes are being implemented at Advanced Refractory Technologies, the prime contractor and silicon carbide whisker manufacturer.

The NATIBO double pin track shoe is not intended for production, but will serve to demonstrate the benefits of the MMC and rubber technologies. A follow-on program called the Aluminum Metal Matrix Composite Implementation Program has been created. It will take the lessons learned from the NATIBO program and take them forward into production via a single pin track design.

The Aluminum Metal Matrix Composite Implementation Program has been structured as a follow on to the NATIBO Insertion Program. The objective of this program is to fabricate and test a selectively reinforced aluminum MMC **single** pin track shoe for the Bradley Fighting Vehicle System which is interchangeable with the current forged steel design with a significant Operation and Support Cost Savings. This will result in weight reduction, improved abrasion resistance, improved rubber pad and bushing life. The design of the single pin track has been finalized. An Integrated Process Team with representation from PM Bradley, the contractor teams, and TARDEC formally meets quarterly. One half of a vehicle set of single pin track has been fabricated and is scheduled to be field evaluated at Keweenaw Research Center (KRC), Houghton, Michigan this winter. Laboratory testing of the wear test coupons was completed. Preliminary wear testing conducted under the NATIBO program indicates that wear

characteristics of the reinforced aluminum far exceed that of forged steel. Comparative testing was conducted which demonstrated that a reinforced aluminum test specimen wore five times better than forged steel. This effort is an 845 Other Transactions cost share agreement. The agreement value is $17,006,135 ($13,774,969 Government share and $3,231,166 contractor share).

The Aluminum Metal Matrix Composite Implementation Program has fabricated a vehicle set of track of the NATIBO design complete with new rubber compound pads and associated hardware such as vehicle hubs and sprockets for field testing. The double pin track was field tested at KRC in excess of 1000 miles. The test course included paved roads, gravel secondary roads, level cross country, and hilly cross country. Other tests conducted were 50% slope climb, 40% side slope, panic stop from 42 miles per hour, and pivot steering. Data analysis is underway.

MMCs for the AMRAAM s Seeker Support structures will dramatically reduce its cost. The current seeker support structure is machined from a piece of titanium pipe. Other materials for the seeker support structure have been considered but could not match the Coefficient of Thermal Expansion (CTE) of titanium. The missile body is constructed of titanium and the seeker support structure must maintain an airtight seal against the body throughout the entire range of temperature that the missile will encounter in storage and service. The design of the MMC part has been simplified. The reinforcement will only be in the ring portion and two aluminum ears will be electron beam welded to the ring. Raytheon Missiles, the manufacturer of the AMRAAM, has conducted thermal evaluation and welding trials of the material. Raytheon Missiles approved the material and the process and the study continues.

Mr. Don Ostberg and Mr. Luis Hinojosa are the Technical Project Officers for this project.

CY2000 Study or Project. The NATIBO Technology Base Enhancement Working Group initiated action to select a technology or technology area for the next study or project. Some of the criteria employed when selecting a NATIBO activity are:

- Dual use
- Criticality to defense requirements
- Opportunity for leverage
- Need for government action
- Status of technology vis-a-vis international competition
- Force multiplier
- Pervasive use by all the Services and the Canadian Forces
- Trade-off assessment — determine where the least amount of funding could be placed to yield the highest potential payback
- Affordability of the technology
- Do not duplicate work in progress

Of particular interest are those technologies reaching a maturation point but have not been adopted by the defense industry. To help narrow the selection field, NATIBO tries to limit the scope to those technologies that have reached the 6.3a budget category.

A strategy planning meeting was held September 22, 1999, to begin discussions on activities where NATIBO could have a role in stimulating technology insertion projects to accelerate implementation of industrial base capabilities to affordably produce the technology. The following ideas were discussed:

1. Sustainability of emerging critical technologies
2. New policy regarding workloading depots/arsenals
3. Total Ownership Cost Reduction (TOCR)
4. Obsolescence
5. JP4 on the battlefield, in generators and unmanned vehicles
6. Handbook on industrial capabilities
7. Government/Industry Data Exchange Program (GIDEP)
8. Best Manufacturing Practices
9. Trend to "All Electric"
10. Diminishing Manufacturing Sources and Materiel Shortages (DMSMS)

The NATIBO Technology Base Enhancement Working Group did not reach consensus on these topics. Therefore, it continues to meet to address some of these ideas and other subjects, identify and scope a project, and develop a work plan.

Other Activities

Steering Group Meeting. The Steering Group meeting, hosted by Canada, was held June 8, 1999 at La Citadelle, Quebec City, Canada. The participants traveled to Val-Belaire to tour the Defence Research Establishment Valcartier (DREV) facility on June 9th.

Marketing. The goal of the Marketing Working Group is to publicize NATIBO s accomplishments and heighten visibility of the organization. In achieving this goal, the NATIBO homepage was developed and linked to various sites. The NATIBO reports can be downloaded from the website. Points of contact and the organization's charter are also on the website. The URL is http://www.dtic.mil/natibo. Updates are made when appropriate.

NATIBO reports are also available on CD-ROM, which is available for distribution at conferences and expositions or by contacting the Secretariat.

Efforts are underway to obtain trademark protection for the NATIBO logo and website. Headquarters, Army Materiel Command legal staff is assisting in this effort.

Exhibit. The NATIBO exhibit is displayed at selected forums, conferences and expositions. The exhibit was at the following events/locations during CY1999.

Jun 14-18	Deputy DDR&E Technology Program Event at the Pentagon
Aug 10-12	North American Aerospace '99, Vancouver, BC, Canada
Oct 31 - Nov 3	Small Business Technology Expo, Miami Beach, Florida

Nov 29 - Dec 2 Defense Manufacturing Conference, Miami Beach, Florida

Memorandum of Understanding (MOU). Efforts are underway to execute a MOU between the U.S. and Canada. This international agreement will provide a modern legal framework for which funds can be transferred between the participants in support of NATIBO studies and projects. After several successful negotiation meetings, the MOU is being staffed at appropriate entities in both countries.

Presentations. Members are frequently invited to make presentations on NATIBO projects to their senior staff or other departments, agencies, activities. In response to calls for papers, submissions are frequently selected for presentation at conferences and symposiums. Some of these events are described below.

- U.S./Canada Armaments Cooperative Management Committee meeting, February 1, 1999, Washington, D.C., NATIBO, Ms. Cynthia Gonsalves
- American Society of Nondestructive Testing 8th Annual Research Symposium, March 23-25, 1999, Orlando, FL, Corrosion Detection Technology Study, MAJ Dennis Clark
- Society of Automotive Engineers, March 1999, Dearborn, Michigan, MMC Insertion Project, Mr. Don Ostberg and Mr. Luis Hinojosa
- Joint Directors of Manufacturing Technology, April 26-28, 1999, Palm Beach, FL, NATIBO, Ms. Cynthia Gonsalves

Sector Study Guide. This publication is a compilation of technology and industrial base sector studies. Included are studies by the military services and civilian government agencies. For each study, a brief abstract is provided, along with the date of the report, the sponsor or originating agency, and where the report can be obtained. Several updates were added to the website document.

Awards. MAJ Dennis Clark and Mr. Rodney White were presented with the NATIBO Chairmen's Award of Achievement in appreciation for their contributions to the organization. Mr. Ken Ready was presented with the Organization Award in recognition of his tenure as Co-Chair of NATIBO. Mr. Ready's direction, insight, and overall contributions have greatly assisted the NATIBO in accomplishing its goal of realizing a broader and stronger technology and industrial base.

Representative Changes. There were several changes to the NATIBO membership during CY99 due to retirements and reassignments. The Organization welcomed Ms. Kristina Namiesniowski as the new Canadian Co-Chair. COL Dan Bulpit and MAJ Norman Saulnier, Canadian Forces, and Mr. Walt Gooley and Mr. Robert Nichol, U.S. Army, were also welcomed.

Contractor Support.

- TRW, formerly BDM Federal, provides engineering and technical support to the Technology Base Enhancement Working Group throughout the course of technology industrial sector analyses. They assist in analyzing collected data to identify R&D efforts underway; current and potential markets; what is needed to transition the technology to market and implement in both defense and commercial systems; and facilitators and barriers to implementation. From these findings, TRW works with the Working Groups to develop a comprehensive roadmap of concrete initiatives to enable the sector to remain/become viable and advance in the current and projected economic environment and aids in the implementation of the plan of action.

- National Systems Management (NSM) Corporation provides support services to the Secretariat. NSM makes arrangements with conference exhibit promoters for facilities and services required for the NATIBO exhibit.

Funding

The NATIBO has no direct funding line in defense budget systems. Projects are funded via funds from the operating budget of member organizations. Contributions for projects for CY1999 follow. Dollars are in U.S. currency.

	Projects	Secretariat
U.S. Army	$ 35,000	115,000
U.S. Navy		
U.S. Air Force	80,000	33,000
U.S. Marines		
Canada	85,000	
Total Calendar Year 1999 Funding	$348,000	

Note: Canadian funding crosses two fiscal years.

In addition to funds, the NATIBO functions with payment in kind contributions from it s members. The U.S. Army supported the Secretariat function, prints and publishes studies and brochures. The U.S. Marine Corps has contributed AAV parts and the U.S. Navy has contributed CH46 parts in support of the ion implantation project and waived exhibit entrance fee for Defense Manufacturing Conference. The U.S. Air Force has provided facilities for NATIBO meetings in the National Capital Region and OSD sponsors the website. Canada has provided materiel for the exhibit.

Planned Activities for Calendar Year 2000

Biological & Hybrid Detection Systems Study. It is anticipated this study will be completed in CY 2000. At the present time, there is a funding shortfall on this project and efforts are being taken to secure additional funding to conduct a complete study and produce a comprehensive report. Funding level will determine the number of site visits to be conducted. Project status will be briefed at the next Steering Group meeting.

Ion Beam Technology Insertion Project.

AAV Elevation Mechanism Gears and Bearings: Continue to work with AAV Program Office to determine where the implanted components should be installed and test conducted. A tracking mechanism must also be implemented so that the components can be returned to NRL for evaluation at the end of the test period.

CH46 Helicopter Planetary Gear: Continue to work with Boeing and the Navy to pursue standard fatigue measurements on ion implanted coupons. If the results of the fatigue measurements are positive, consider testing.

Rolling Contact Fatigue (RCF) Testing on Ion Implanted Rods: For precision bearings used in military aircraft, RCF is a critical parameter affecting component life. Since it has already been determined that ion implantation can significantly increase corrosion resistance, it must be proved that ion implantation does not degrade RCF lifetime. Fifteen RCF test rods were fabricated, polished, and implanted. Testing is scheduled for January 2000.

Metal Matrix Composite Insertion Project. The technical portion of the NATIBO track project is complete. The final report for the entire project will be published in CY2000. AMRAAM seeker support structures will be fabricated and evaluated by Raytheon Missiles for implementation.

The NATIBO follow on program will continue to develop the single pin design for implementation of the Bradley Fighting Vehicle System. Sufficient track will be fabricated and assembled for qualification testing at Yuma Proving Ground and Aberdeen Proving Ground. An economic analysis of the MMC track is continually revised, as new test results become available.

The Tank Automotive Research, Development, and Engineering Center (TARDEC) will complete mechanical property testing of the MMC material in FY2000. Properties that will be quantified include toughness and impact at different whisker loadings and temperature.

Next Technology Study or Project. The NATIBO New Technology Working Group is interested in initiating a study or project to analyze technology or industrial base issues that are of concern to both Defense Departments. The working group will continue to meet to scope a study or project and develop a work plan. The plan will be presented for approval at the next Steering Group meeting.

Memorandum of Understanding. Anticipate MOU formal agreement and implementation in CY2000. When the MOU is implemented, Project Arrangements (PAs) can be written for NATIBO activities. The PA specifies all of the conditions, criteria, responsibilities, and obligations the participants need to fulfill in order to make the joint project succeed. A brochure will be developed and used as a handout to inform the technology and industrial base community of the availability of the MOU for their use.

Exhibit Schedule. The tentative NATIBO exhibit schedule for CY2000 follows.

May	Global Air & Space 2000 Exhibition, Crystal City
September	Canada Defence Industries Association (CDIA), Ottawa, Canada
October	PM/PEO Commander's Conference, Ft. Belvoir, VA
October	Association of U.S. Army, Washington, DC
November	Small Business Technology Expo, Seattle, WA
December	Defense Manufacturing Conference, Tampa, FL

Conclusion

The NATIBO is a driving force behind the U.S./Canadian defense technology and industrial base program. It is an organized vehicle for coordination and cooperation between the two Defense Departments. The 21st century provides us with an opportunity to shape a safer, freer world. By working together for the interests and values we share, we can respond to the political and humanitarian crises affecting so much of the world.

In an era of declining defense budgets, changing threats to national security, and increasing "equipment geriatrics", the North American defense industrial base faces the challenges of advancing and maintaining technological superiority with reduced government research and development funding. As we enter the 21st century, meeting these challenges requires the leveraging and promoting of commercial use and investment in technologies which will have both defense and industrial applications. Broadening the technology industrial base to include both U.S. and Canadian resources so that investment costs may be shared across a broader base will better prepare us to face these challenges and improve the affordability of defense systems.

Appendix A

NATIBO Membership

NATIBO Steering Group
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